

BOECHERA YORKII (BRASSICACEAE), A NARROW ENDEMIC FROM THE
LAST CHANCE RANGE, DEATH VALLEY NATIONAL PARK,
INYO COUNTY, CALIFORNIA

STEVE BOYD

Herbarium, Rancho Santa Ana Botanic Garden, Claremont, CA 91711,
steve.boyd@cgu.edu

ABSTRACT

Boecheira yorkii S. Boyd is described as a new species. It is a narrow endemic from the Last Chance Range in Death Valley National Park, Inyo County, California, apparently restricted to carbonate substrate. *Boecheira yorkii* is distinguished from all other *Boecheira* taxa in the Death Valley region by having reflexed flowers and yellow petals with brick-red tips (rarely all yellow or all brick-red) rather than all white, pinkish, purple, or some combination of these. Conservation concerns are limited as all currently known populations occur in a relatively inaccessible area, entirely within Death Valley National Park boundaries.

Key Words: *Boecheira*, *Arabis*, Brassicaceae, carbonate, endemic, Last Chance Range, Death Valley.

Dana York, Death Valley National Park Botanist, encountered an unfamiliar Brassicaceae growing on carbonate substrate in the Last Chance Mountains, east of Eureka and Saline valleys during the spring of 2000. In leaf vestiture, overall floral morphology, and habit, the plants were well-placed within the genus *Boecheira* Löve & Löve, but were noteworthy in having reflexed flowers with the petals yellow proximally becoming reddish at the tips, as opposed to the purplish, pinkish, or whitish petals found in other *Boecheira* taxa known from the region. York collected a voucher specimen in flower and young fruit, and photographed the plants *in situ*. These were sent to me for examination. York provided additional flowering specimens collected in 2001, but was unable to find mature fruit due to extensive herbivory of plants within the population.

Comparing York's specimens to material in the herbarium of Rancho Santa Ana Botanic Garden (RSA-POM) and to descriptions in various floristic and monographic treatments, I was unable to ascribe these to any known *Boecheira* taxon. A suite of vegetative and floral characters, in particular leaf vestiture, floral orientation, corolla symmetry, and petal color, readily distinguishes York's plants from other species of *Boecheira*. Consequently, I propose here the recognition of a new species, *Boecheira yorkii*.

Boecheira yorkii S. Boyd, sp. nov. (Fig. 1).— Type: USA, California, Last Chance Range, on the N side of a canyon 440 m S of Last Chance Mountain; 37°16'35.9"N, 117°41'47.2"W (NAD 27); 2410 m (7910 feet); 16 May 2001, Dana York & Kathy Davis 2611 (holotype RSA; isotypes CAS, MO). Paratype: USA, California, Last Chance Range, on the N side of a canyon 880 m SW of Last Chance Mountain; 37°16'24.9"N, 117°42'17.4"W (NAD 27), 2220 m (7280 feet); 16

May 2001, Dana York & Kathy Davis 2616 (DEVA).

Differt a *B. dispar* (M.E. Jones) Al-Shehbaz et *B. inyoensis* (Rollins) Al-Shehbaz floribus reflexis corollis subzygomorphis petalis proximalium florum distalium lateritorum (vel totis florum vel totis lateritorum) ovariis pubescentibus dendriticis.

Perennial herb from ± branched, woody caudex; stems erect, 10–30 cm long, unbranched or with small lateral branches at the uppermost cauline leaves, tomentum moderately dense with numerous short, dendritic trichomes and scattered longer, few-branched trichomes, especially below inflorescence; basal leaves gray-green, numerous, ascending, entire, linear-oblong to spatulate, apex acute to ± rounded, 0.5–4 cm long (including the broad petiole), 1.5–3 mm wide, leaf epidermis readily visible under tomentum of numerous loose dendritic trichomes and scattered longer, entire to few-branched hairs; cauline leaves gray-green, grading from linear-oblong to lanceolate below to linear or narrowly lanceolate near the inflorescence, but not much reduced in length, auricles lacking or vestigial, vestiture similar to basal leaves, but dendritic trichomes less dense; inflorescence racemose, lowest 1–2(3) flowers often subtended by narrow linear bracts 4–6(10) mm long, ± similar to cauline leaves or with narrow hyaline margin that lacks trichomes (i.e., ± sepaloid), pedicels stout, short, reflexed, 1–1.5 mm at anthesis, with dense, short, dendritic trichomes; flowers ± reflexed at anthesis; calyx cylindric, sepals linear-oblong, greenish, ca. 5 mm long, 1.2 mm wide, with moderately dense dendritic trichomes abaxially; corolla slightly zygomorphic due to petal orientation, petals erect, the tips and upper 1/3 of blade spreading-recurved, linear, 9–10 mm long, ca. 0.8 mm wide, brick-red in distal 1/3 grading to pale yellow (rarely yellow or

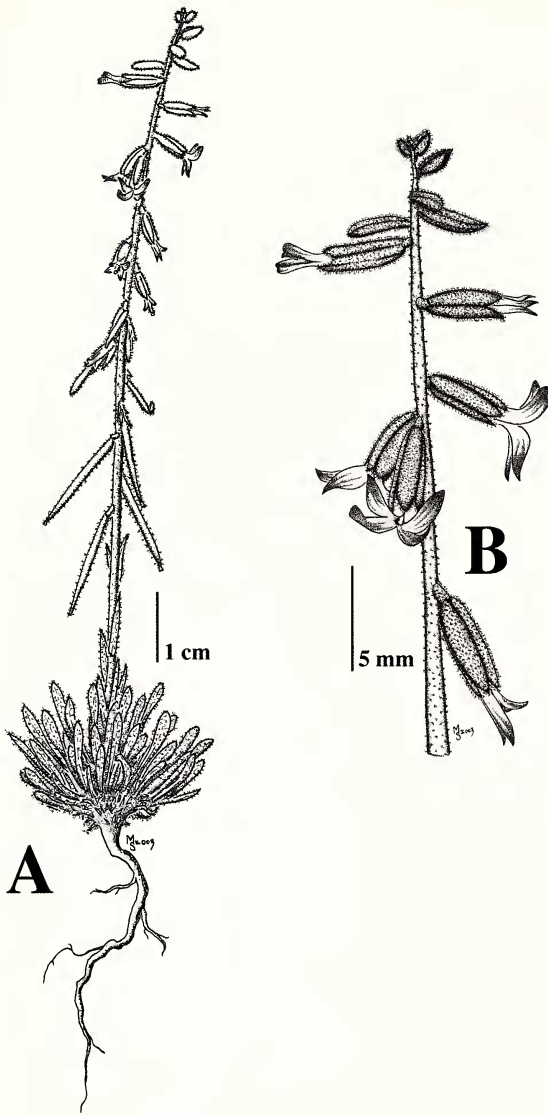


FIG. 1. *Boecheera yorkii*. A) general habit of a flowering rosette in early fruit. B) detail of upper inflorescence showing vestiture of stem and calyces, \pm deflexed orientation of flowers at full anthesis, and slight zygomorphy of corollas.

brick-red throughout), glabrous or with a few scattered dendritic trichomes on abaxial surface distally; *stamens* 6, tetradynamous, included, filaments pale yellow, \pm equal, ca. 4 mm long, anthers of longer stamens ca. 1.2 mm long, those of shorter stamens ca. 1.6 mm, pollen ellipsoid, tricolpate (Fig. 2); *ovary* linear, ca. 2.5 mm long at anthesis, densely covered with short, dendritic trichomes, style ca. 0.25 mm long, stigma \pm 2-lobed; *fruit* a narrowly linear capsule on reflexed pedicel (Fig. 3), moderately to sparsely pubescent with short dendritic trichomes, straight or very slightly arcuate (fully mature fruit and seeds unknown).

The specific epithet honors Dana York, Death Valley National Park Botanist, who discovered the plant. He suggests using "Last Chance rock cress" as the vernacular name for this rare species.

DISCUSSION

Recent molecular, morphological, and cytological studies have demonstrated the genus *Arabis*, as traditionally and broadly circumscribed (e.g., Rollins 1993), to be polyphyletic, representing an assemblage of four genera: *Arabidopsis*, *Boecheera*, *Pennellia*, and *Turritis*, in addition to *Arabis* s. str. (Al-Shehbaz 2003). In the New World, the majority of taxa traditionally treated as *Arabis* s.l. have a base chromosome number of $x = 7$, and comprise the genus *Boecheera* (Al-Shehbaz 2003). *Boecheera*, as presently circumscribed, is most diverse in western North America, especially within the Great Basin and Mojave deserts (Rollins 1941, 1993; Al-Shehbaz 2003).

At least 14 taxa of *Boecheera* are known from the Death Valley region of eastern Inyo County, California (Kurzius 1981; Norris 1982; Schramm 1982; DeDecker 1984; Annable 1985; Peterson 1986). The Death Valley region is interpreted here as including the Argus and Inyo mountain ranges, as well as the valleys and ranges adjacent to Death Valley, but excluding the White Mountains. This is an area transitional between the Great Basin and Mojave Desert floristic regions, and noted for supporting large number of endemic species and genera (Raven 1977). Other *Boecheera* taxa documented from the Death Valley region include *B. cobrensis* (M.E. Jones) Dorn, *B. dispar* (M.E. Jones) Al-Shehbaz, *B. glaucovalvula* (M.E. Jones) Al-Shehbaz, *B. holboellii* (Hornem.) A. Löve & D. Löve (incl. *Arabis holboellii* Hornem. var. *pendulocarpa* (A. Nelson) Rollins, *A. holboellii* var. *retrofracta* (Graham) Rydb.), *B. inyoensis* (Rollins) Al-Shehbaz, *B. lyallii* (S. Watson) Dorn (incl. *Arabis davidsonii* Greene var. *parva* Rollins), *B. microphylla* (Nutt.) Dorn var. *microphylla*, *B. perennans* (S. Watson) W.A. Webber, *B. pulchra* (M.E. Jones ex S. Watson) W.A. Webber var. *gracilis* (M.E. Jones) Dorn, *B. pulchra* var. *munciensis* (M.E. Jones) Dorn, *B. pulchra* var. *pulchra*, *B. shockleyi* (Munz) Dorn, and *B. sparsiflora* (Nutt.) Dorn var. *sparsiflora*.

In overall appearance, *Boecheera yorkii* is vegetatively similar to many *Boecheera* taxa from the arid mountains of western North America; i.e., generally caespitose, each rosette a dense cluster of spatulate to narrowly oblanceolate leaves appearing gray-green to ashy-white due to a tomentum of low, dendritic trichomes. Of those *Boecheera* taxa previously documented from the Death Valley region, *B. yorkii* is most similar vegetatively to *B. dispar* (leaf shape, overall habit, size of rosettes) and *B. inyoensis* (leaf shape, tomentum). It is readily separable from these two taxa by several floral and

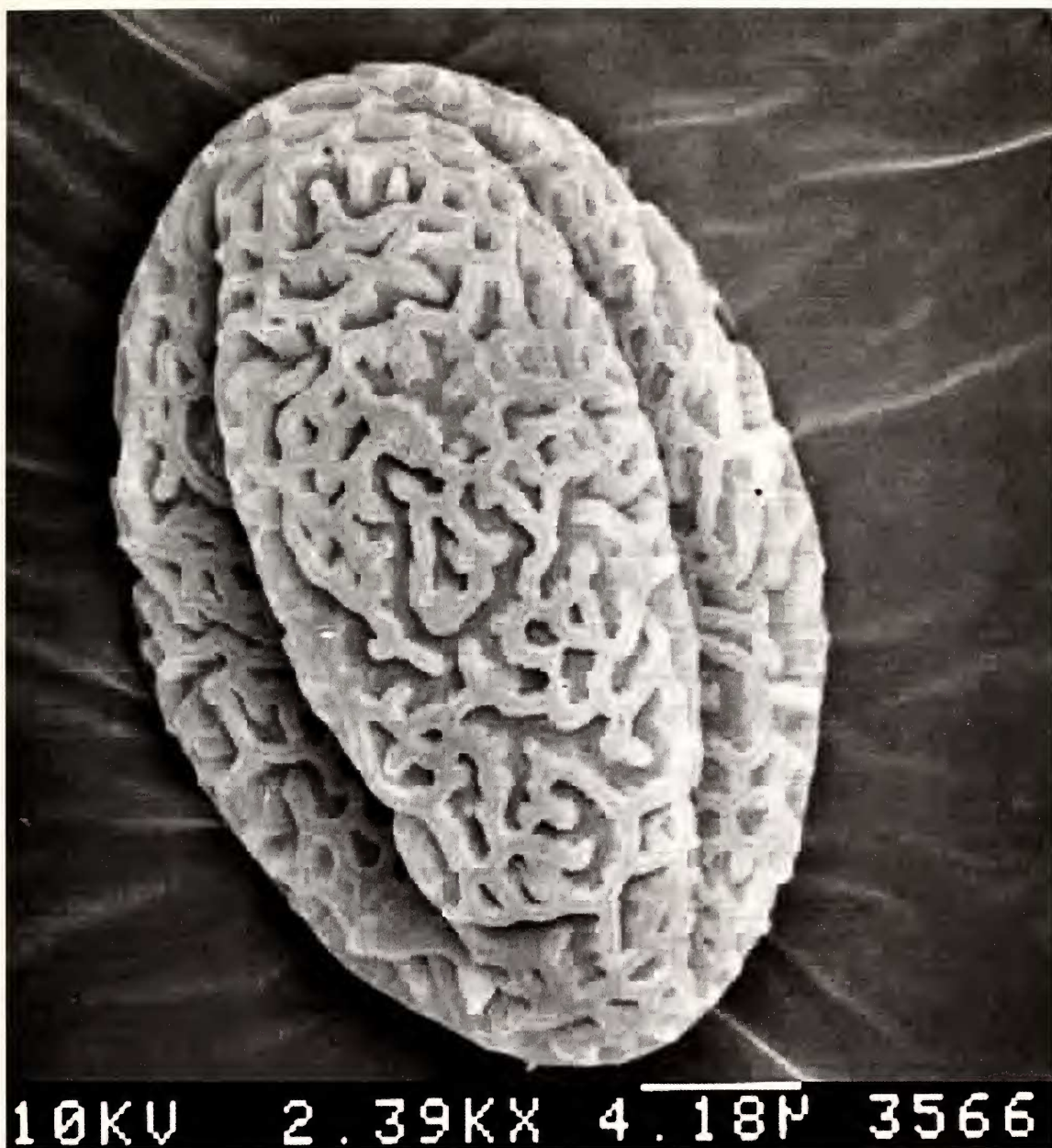


FIG. 2. Scanning electron micrograph (SEM) of ellipsoid, tricolpate pollen grain of *Boechera yorkii* [York & Davis 2611 (RSA)].

fruit characters, however. The most striking differences among these three taxa are found in the color, size, and shape of the petals, pedicel angle in fruit, and vestiture of the young fruit.

Boechera yorkii stands out among nearly all species of *Boechera*, including *B. dispar* and *B. inyoensis*, in having \pm zygomorphic corollas (resulting from petal orientation vs. size differences between petals) with petals that are yellow, grading to brick-red at the tips (rarely all yellow or all brick-red) rather than some variation of white, pink,

or purple. Rollins (1993) reports two North American species of *Arabis* s.l. having yellowish white petals, *A. glabra* (L.) Bernh. and *A. missouriensis* Greene. These two taxa are taprooted biennials, very different in habit and overall morphology than *B. yorkii*. *Arabis glabra* is properly treated as *Turritis glabra*, while *A. missouriensis* is a member of *Boechera*.

Both *Boechera dispar* and *B. inyoensis* have slightly shorter sepals (4 mm) than *B. yorkii* (5 mm), as well as shorter petals. The petals of *B.*



FIG. 3. *Boechera yorkii* growing in crevice of carbonate outcrop, showing reflexed flowers and young fruit. (Photograph by Dana York).

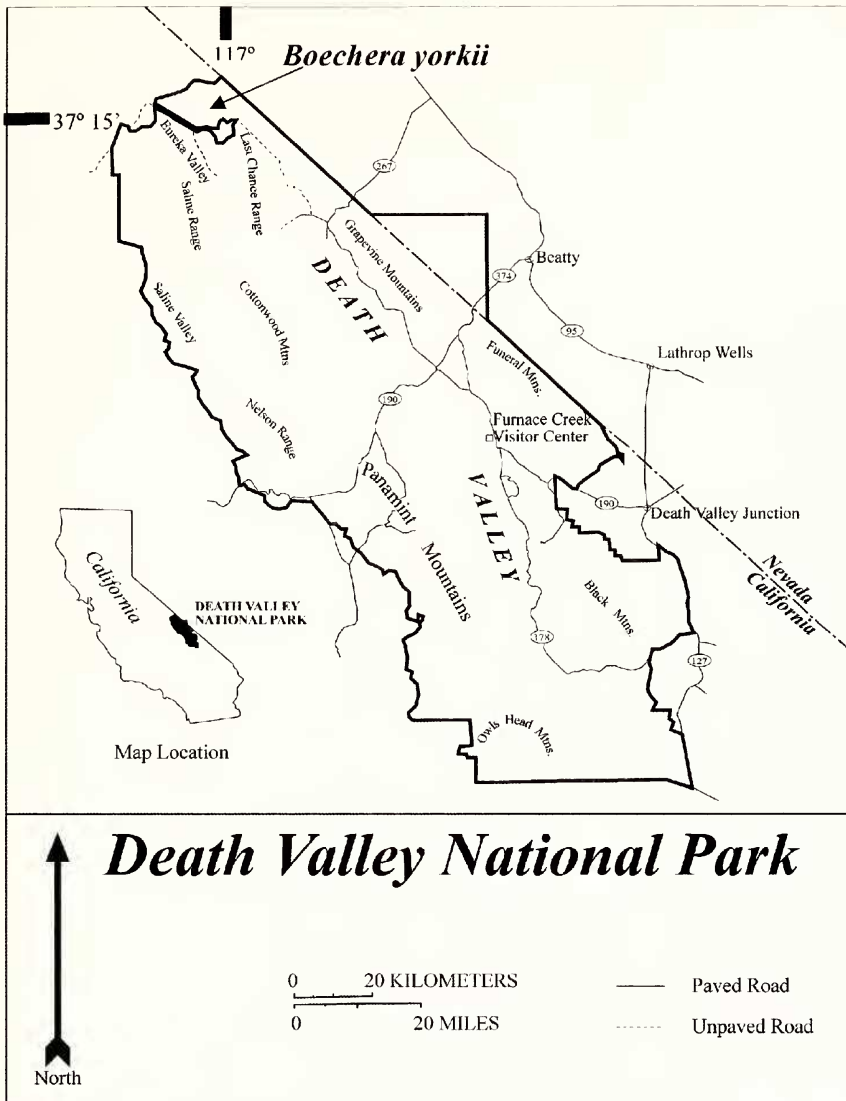


FIG. 4. Map of Death Valley National Park showing general location of the Last Chance Range and *Boechera yorkii* population.

dispar are 5–6 mm long and those of *B. inyoensis* are 7–9 mm, while in *B. yorkii* the petals are 9–10 mm. The petals of *B. yorkii* are narrow, ca. 0.8 mm, and \pm linear, while those of *B. dispar* are ca. 2 mm wide and obovate, and those of *B. inyoensis* are ca. 2 mm wide and lingulate to spatulate.

The ovaries and young capsules of *B. yorkii* are uniformly covered with short, dendritic trichomes. Both *B. dispar* and *B. inyoensis* have young fruit which are essentially glabrous. As noted above, mature capsules of *B. yorkii* have not been documented, thus it is unclear to what extent the vestiture seen in young fruit is retained at maturity.

The pedicels of *B. yorkii* are short, ca. 1–1.5 mm at anthesis and in early fruit. Although the extent of pedicel elongation in mature fruit of *B. yorkii* is

unknown at this writing, specimens of *B. dispar* and *B. inyoensis* have much longer pedicels relative to *B. yorkii* at the same stage in early fruit. The pedicels of *B. yorkii* are sharply reflexed while those of *B. dispar* are nearly erect to divaricately ascending, and those of *B. inyoensis* spread at right angles from the stem. *Boechera yorkii* shares with several other *Boechera* taxa from the Death Valley region an infructescence with reflexed or descending pedicels, including *B. cobrensis*, *B. holboellii*, *B. perennans*, *B. pulchra*, and *B. sparsiflora*. From all these taxa *B. yorkii* differs in floral color, corolla symmetry, leaf vestiture, and with the exception of *B. cobrensis*, overall habit.

The only species of *Boechera* currently known to grow sympatric with *B. yorkii* is *B. shockleyi*. Both

taxa grow in the same habitat, crevices of rock outcrops, and both are relatively scarce within the area. *Boecheira shockleyi* is readily identifiable by its very dense, pannose leaf tomentum of short, stellate hairs, its long, spreading pedicels, and long, narrow, arcuate fruit. Although I considered the possibility that *B. yorkii* represents the result of hybridization between two other *Boecheira* taxa, I believe it is unlikely given the relative rarity of *B. shockleyi*, and apparent absence of any other putative parental taxa within the known populations.

Boecheira yorkii is a narrow endemic, restricted to the upper slopes of Last Chance Mountain in the Last Chance Range of northeastern Inyo County, California. All known populations occur within the boundaries of Death Valley National Park (Fig. 4).

Sedimentary rocks dominate the surficial geology of the Last Chance Range. *Boecheira yorkii* has been found only on dolomites in the Nopah Formation, where it grows in crevices and on ledges of south-facing walls of canyons. The dolomite of the Nopah Formation is light- to medium-gray colored, with generally fine grains (McKee 1968).

Vegetation in the area where *Boecheira yorkii* grows on the upper slopes of Last Chance Mountain (between ca. 2100–2545 m elevation) is a pinyon-juniper woodland dominated by *Pinus monophylla* Torr. & Frém. and *Juniperus osteosperma* (Torr.) Little. Other plants associated with *Boecheira yorkii* include *Allium atrorubens* S. Watson var. *cristatum* (S. Watson) McNeal, *Boecheira shockleyi*, *Argyrochosma jonesii* (Maxon) Windham, *Artemisia nova* A. Nelson, *Astragalus mohavensis* S. Watson var. *mohavensis*, *A. panamintensis* E. Sheldon, *Camissonia walkeri* (A. Nelson) P.H. Raven subsp. *tortilis* (Jepson) P.H. Raven, *Cercocarpus intricatus* S. Watson, *Chaetopappa ericoides* (Torr.) G.L. Nesom, *Chrysothamnus granineus* H.M. Hall, *C. nauseosus* (Pall.) Britton subsp. *hololeucus* (A. Gray) H.M. Hall & Clem., *Cryptantha roosiorum* Munz, *Echinocereus triglochidiatus* Engelm., *Ephedra viridis* Coville, *Ericameria nana* Nutt., *Eriogonum heermannii* Durand & Hilg. s.l., *Fendlerella utahensis* (S. Watson) A. Heller, *Gutierrezia microcephala* (DC.) A. Gray, *Lepidospartum latisquamum* S. Watson, *Leptodactylon pungens* (Torr.) Rydb., *Mimulus rupicola* Coville & A.L. Grant, *Penstemon fruticiformis* Coville s.l., *P. scapoides* D.D. Keck, *Phacelia affinis* A. Gray, *P. perityloides* Coville, *Purshia mexicana* (D. Don) S.L. Welsh var. *stansburyana* (Torr.) S.L. Welsh, *Scopolophila rixfordii* (Brandegee) Munz & I.M. Johnston., *Symphoricarpos longiflorus* A. Gray, and *Tetradymia canescens* DC.

CONSERVATION STATUS

All of the known occurrences of *B. yorkii* are found within the boundaries of Death Valley National Park in a remote and relatively inaccessible area. There are no identifiable threats from human

activities, and all known populations appear secure at this time.

ACKNOWLEDGMENTS

I wish to thank Dana York for bringing this interesting new *Boecheira* to my attention, for providing helpful photographs of the plant in flower and a detailed description of the plant's habitat, and for producing the map. Naomi Fraga kindly prepared and conducted an examination of pollen grains using SEM. I am especially indebted to Marisa Sripracha for making the line drawing of *B. yorkii*, work done in the evenings after having spent the previous 10–12 hours conducting floral and faunal transects on the Coachella Valley sand dunes under a blazing Colorado Desert sun, and to my son Kyle, for his assistance on a difficult, late June excursion to examine *B. yorkii* habitat in the Last Chance Mountains. Finally I thank Dr. Ihsan Al-Shehbaz and an anonymous reviewer for their insightful and helpful comments which have added much to the quality of this paper.

LITERATURE CITED

AL-SHEHBAZ, I. A. 2003. Transfer of most North American species of *Arabis* to *Boecheira* (Brassicaceae). *Novon* 13:381–391.

ANNABLE, C. R. 1985. Vegetation and flora of the Funeral Mountains, Death Valley National Monument, California–Nevada. CPSU/UNLV Contribution No. 016/07 National Park Service/University of Nevada, Las Vegas, NV.

DEDECKER, M. 1984. Flora of the northern Mojave Desert, California. California Native Plant Society Special Publication No. 7. California Native Plant Society, Sacramento, CA.

KURZIUS, M. 1981. Vegetation and flora of the Grapevine Mountains, Death Valley National Monument, California–Nevada. CPSU/UNLV Contribution No. 017/06. National Park Service/University of Nevada, Las Vegas, NV.

MCKEE, E. H. 1968. Geology of the Magruder Mountain area, Nevada–California. U.S. Geological Survey Bulletin 1251-H. U.S. Geological Survey, Washington, DC.

NORRIS, L. L. 1982. A checklist of the vascular plants of Death Valley National Monument. Death Valley Natural History Association, Death Valley, CA.

PETERSON, P. M. 1986. A flora of the Cottonwood Mountains, Death Valley National Monument, California. *Wassman Journal of Biology* 44:73–126.

RAVEN, P. H. 1977. The California flora. Pp. 109–137 in M. G. Barbour and J. Major (eds.), *Terrestrial vegetation of California*. John Wiley & Sons, New York, NY.

ROLLINS, R. C. 1941. A monographic study of *Arabis* in western North America. *Rhodora* 43:289–325; 348–411; 425–481.

———. 1993. *The Cruciferae of continental North America: systematics of the mustard family from the Arctic to Panama*. Stanford University Press, Stanford, CA.

SCHRAMM, D. R. 1982. Floristics and vegetation of the Black Mountains, Death Valley National Monument, California. CPSU/UNLV Contribution No. 012/12. National Park Service/University of Nevada, Las Vegas, NV.